



RADIO TEST REPORT

Test Report No. : 11451821H-A-R1

Applicant : FUJITSU COMPONENT LIMITED
Type of Equipment : Bluetooth Low Energy Module
Model No. : FWM7BLZ20
FCC ID : SQK-7BLZ20
Test regulation : FCC Part 15 Subpart C: 2016
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11451821H-A. 11451821H-A is replaced with this report.

Date of test: September 18 to October 14, 2016

Representative test engineer:

Masafumi Niwa

Engineer

Consumer Technology Division

Approved by:

Takayuki Shimada

Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

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SECTION 1: Customer information

Company Name	:	FUJITSU COMPONENT LIMITED
Address	:	Shinagawa Seaside Park Tower, 12-4, Higashi-shinagawa 4-chome, Shinagawa-ku, Tokyo, 140-8586, Japan
Telephone Number	:	+81-3-3450-1639
Facsimile Number	:	+81-3-3474-2372
Contact Person	:	Takeshi Wakui

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Low Energy Module
Model No.	:	FWM7BLZ20
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V (DC 1.7 to 3.6 V)
Receipt Date of Sample	:	September 15, 2016
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: FWM7BLZ20 (referred to as the EUT in this report) is a Bluetooth Low Energy Module.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.3 V
Antenna type	:	Mono-pole antenna
Antenna Gain	:	-0.4 dBi
Clock frequency (Maximum)	:	32 MHz
Operating temperature	:	-40 deg. C to +85 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC part 15 final revised on April 6, 2016.

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	[QP] 7.4 dB, 0.19970 MHz, N, 0.19994 MHz, L [AV] 19.3 dB, 0.19994 MHz, L	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	1.5 dB 4960.000 MHz, AV, Horizontal	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r05 12.2.7.

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

This EUT provides stable voltage (DC 1.3 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.
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Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz -3 GHz	3 GHz -18 GHz	18 GHz -26.5 GHz	26.5 GHz -40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 – 0.15MHz	3.5 dB
0.15 – 30MHz	3.0 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

*Measurement distance

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

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3.5 Test Location

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Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

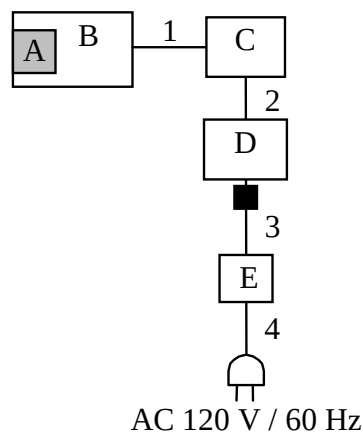
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Bluetooth (BT) Low Energy (LE): Transmitting (Tx)

Test Item	Operating Mode	Tested Frequency
Conducted Emission, 6dB Bandwidth, Maximum Peak Output Power, Spurious Emission (Radiated / Conducted), Power Density, 99% Occupied Bandwidth	Tx BT LE	2402MHz 2440MHz 2480MHz
*Power of the EUT was set by the software as follows; Power settings: High: 4 dBm, Low: -20 dBm Software: BLZ20_DTM, v1.0.0 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.		

4.2 Configuration and peripherals



■ : Standard Ferrite Core

* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support Equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Low Energy Module	FWM7BLZ20	1 *1) 12 *2)	FUJITSU COMPONENT LIMITED	EUT
B	Jig	-	-	FUJITSU COMPONENT LIMITED	*3)
C	Jig	-	-	FUJITSU COMPONENT LIMITED	-
D	Laptop PC	CF-N8HWCDPS	0BKSA08725	Panasonic	-
E	AC Adapter	CF-AA6372B	6372BM610701051E	Panasonic	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.3	Unshielded	Unshielded	-
2	USB Cable	0.9	Shielded	Shielded	-
3	DC Cable	1.1	Unshielded	Unshielded	-
4	AC Cable	0.9	Unshielded	Unshielded	-

*1) Used for all test other than Maximum Peak Output Power and Average Output Power test (Low Power setting)

*2) Used for Maximum Peak Output Power and Average Output Power test (Low Power setting) only

*3) The test was performed with the module that as normal assumed implementation conditions. (without a solid ground)

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz – 30 MHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r05".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	4.5 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)		4.5 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r05".

*2) Distance Factor: $20 \times \log(4.5 \text{ m} / 3.0 \text{ m}) = 3.53 \text{ dB}$

*3) Distance Factor: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

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- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range	: 30 MHz - 26.5 GHz
Test data	: APPENDIX
Test result	: Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	2 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r05". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)							

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data	: APPENDIX
Test result	: Pass

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APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

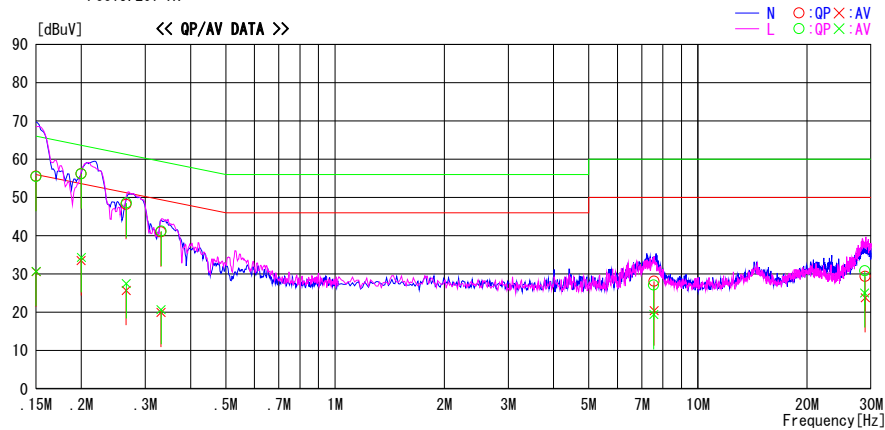
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2016/09/20

Report No. : 11451821H

Temp./Humi. : 21deg. C / 58% RH
Engineer : Takafumi Noguchi

Mode / Remarks : Tx 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV

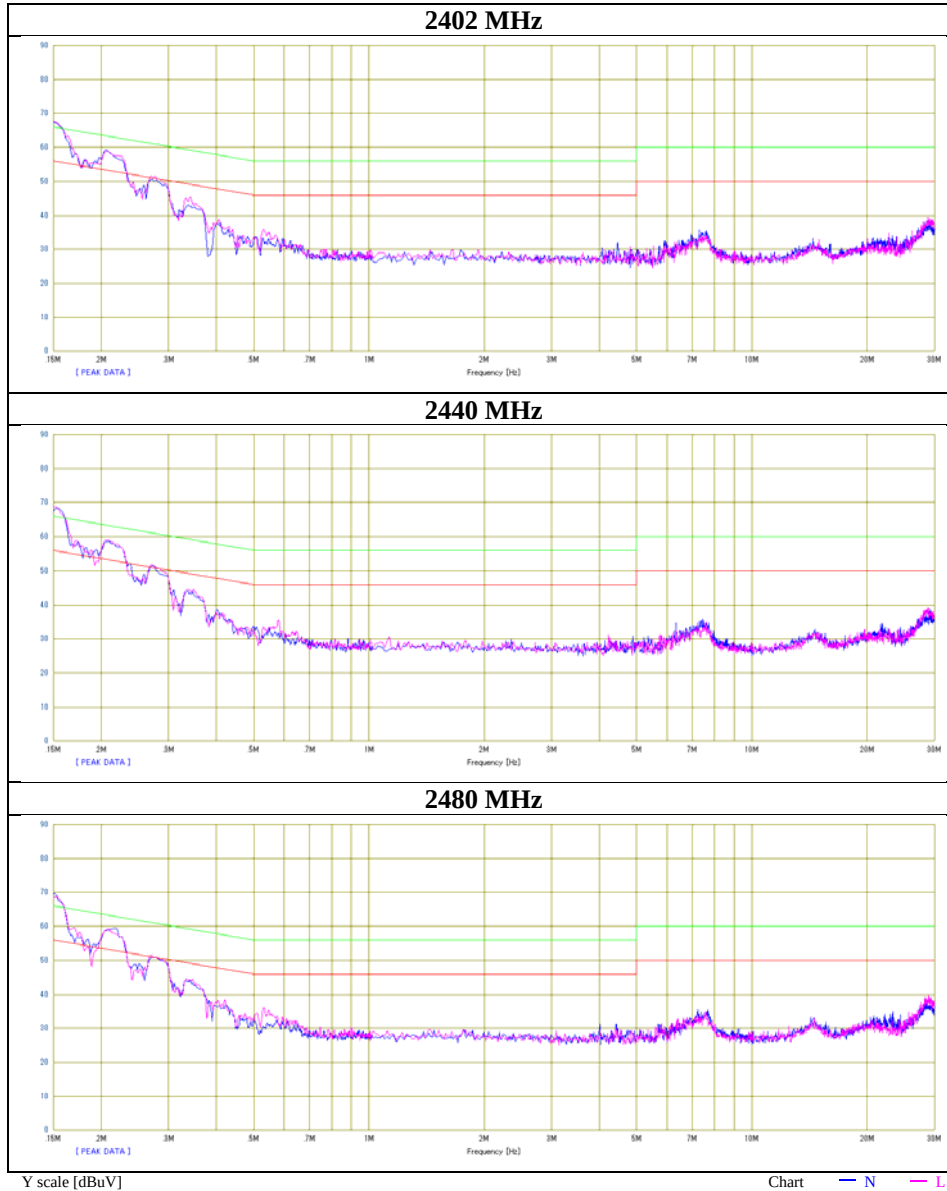


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	42.4	17.4	13.2	55.6	30.6	66.0	56.0	10.4	25.4	N	
0.19970	43.0	20.3	13.2	56.2	33.5	63.6	53.6	7.4	20.1	N	
0.26575	35.0	12.5	13.2	48.2	25.7	61.2	51.2	13.0	25.5	N	
0.33145	27.8	6.8	13.2	41.0	20.0	59.4	49.4	18.4	29.4	N	
7.57599	14.1	6.4	14.0	28.1	20.4	60.0	50.0	31.9	29.6	N	
28.89971	14.1	8.5	15.3	29.4	23.8	60.0	50.0	30.6	26.2	N	
0.15000	42.3	17.5	13.2	55.5	30.7	66.0	56.0	10.5	25.3	L	
0.19994	43.0	21.1	13.2	56.2	34.3	63.6	53.6	7.4	19.3	L	
0.26594	35.4	14.3	13.2	48.6	27.5	61.2	51.2	12.6	23.7	L	
0.33166	28.0	7.5	13.2	41.2	20.7	59.4	49.4	18.2	28.7	L	
7.55899	13.1	5.4	14.0	27.1	19.4	60.0	50.0	32.9	30.6	L	
28.79654	15.5	9.8	15.3	30.8	25.1	60.0	50.0	29.2	24.9	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTN + CABLE)
Except for the above table : adequate margin data below the limits.

Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11451821H
Date	September 20, 2016
Temperature / Humidity	21 deg. C / 58 % RH
Engineer	Takafumi Noguchi
Mode	Tx BT LE



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6dB Bandwidth

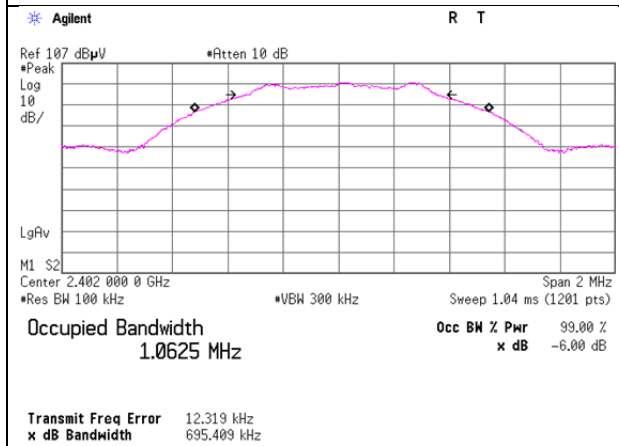
Test place Ise EMC Lab. No.4 Measurement Room
Report No. 11451821H
Date September 19, 2016
Temperature / Humidity 20 deg. C / 58 % RH
Engineer Masafumi Niwa
Mode Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.695	> 500
	2440	0.690	> 500
	2480	0.697	> 500

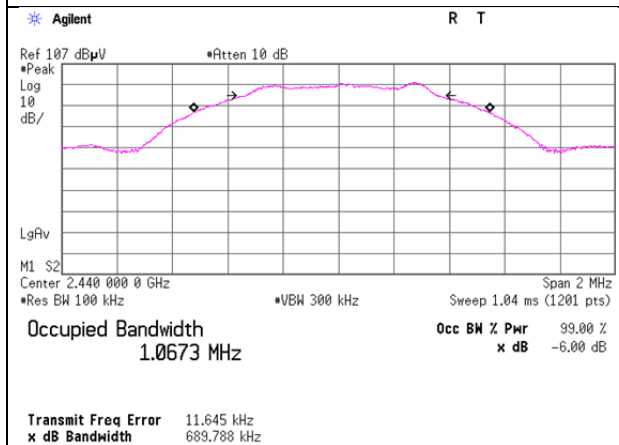
6dB Bandwidth

BT LE

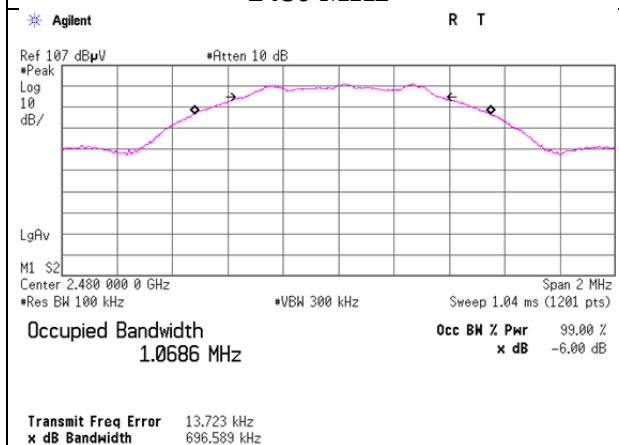
2402 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place	Ise EMC Lab.	
Report No.	11451821H	
Measurement Room	No.4	No.7
Date	September 19, 2016	October 14, 2016
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 51 % RH
Engineer	Masafumi Niwa	Satofumi Matsuyama
Mode	Tx BT LE	

High Power setting (4dBm)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-9.37	1.70	10.06	2.39	1.73	30.00	1000	27.61
2440	-9.26	1.71	10.06	2.51	1.78	30.00	1000	27.49
2480	-9.21	1.72	10.06	2.57	1.81	30.00	1000	27.43

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

*The equipment and cables were not used for factor 0 dB of the data sheets.

Low Power setting (-20dBm)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-20.20	0.70	10.03	-9.47	0.11	30.00	1000	39.47
2440	-20.34	0.70	10.03	-9.61	0.11	30.00	1000	39.61
2480	-20.01	0.70	10.03	-9.28	0.12	30.00	1000	39.28

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab.	
Report No.	11451821H	
Measurement Room	No.4	No.7
Date	September 19, 2016	October 14, 2016
Temperature / Humidity	20 deg. C / 58 % RH	24 deg. C / 51 % RH
Engineer	Masafumi Niwa	Satofumi Matsuyama
Mode	Tx BT LE	

High Power setting (4dBm)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-10.22	1.70	10.06	1.54	1.43	0.68	2.22	1.67
2440	-10.13	1.71	10.06	1.64	1.46	0.68	2.32	1.71
2480	-10.04	1.72	10.06	1.74	1.49	0.68	2.42	1.75

Sample Calculation:

Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

Result (Burst power average) = Time average + Duty factor

*The equipment and cables were not used for factor 0 dB of the data sheets.

Low Power setting (-20dBm)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-31.28	0.70	10.03	-20.55	0.01	0.68	-19.87	0.01
2440	-30.66	0.70	10.03	-19.93	0.01	0.68	-19.25	0.01
2480	-30.42	0.70	10.03	-19.69	0.01	0.68	-19.01	0.01

Sample Calculation:

Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

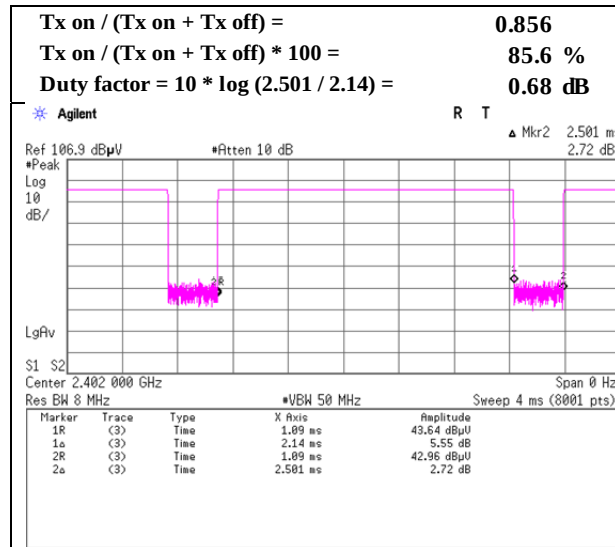
Result (Burst power average) = Time average + Duty factor

*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 11451821H
Date September 18, 2016
Temperature / Humidity 23 deg. C / 69 % RH
Engineer Yuta Moriya
(1 GHz - 10 GHz)
Mode Tx BT LE 2402 MHz

BT LE



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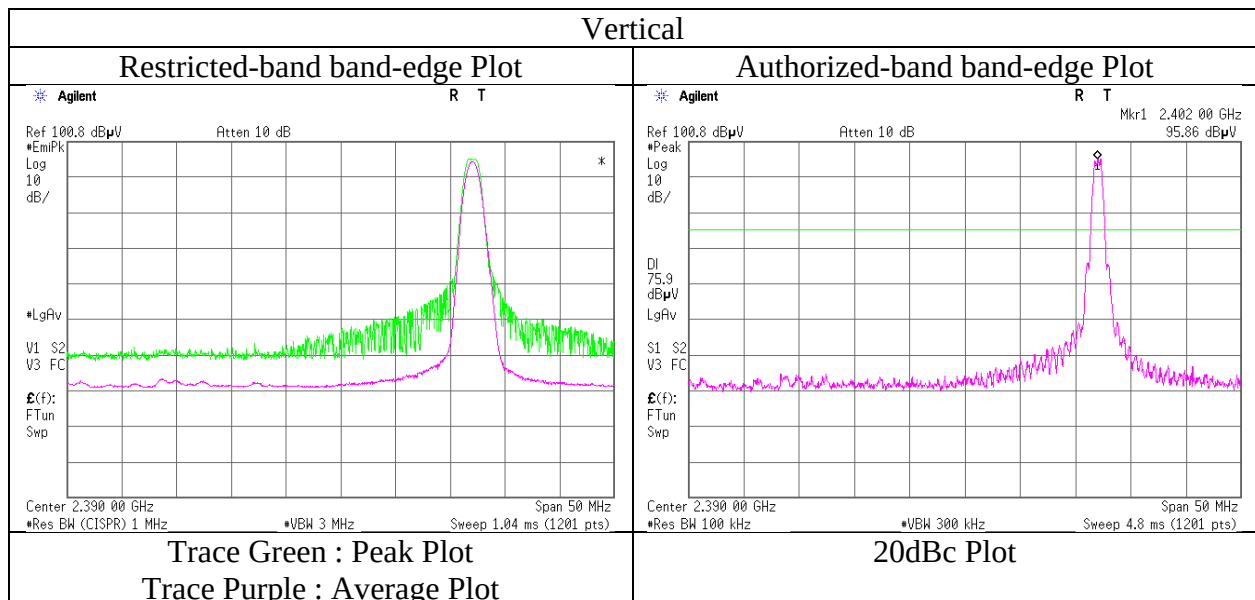
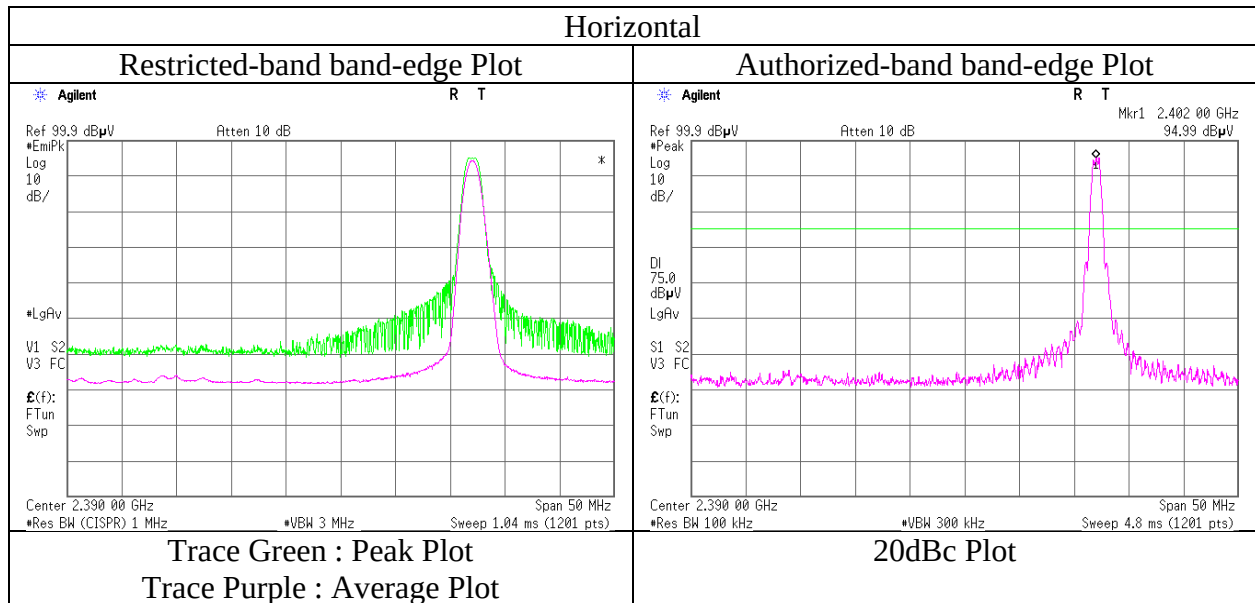
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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11451821H
Date	September 18, 2016
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Yuta Moriya
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz



* Final result of restricted band edge was shown in tabular data.

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Radiated Spurious Emission

Test place	Ise EMC Lab.	
Report No.	11451821H	
Semi Anechoic Chamber	No.4	No.2
Date	September 18, 2016	September 19, 2016
Temperature / Humidity	23 deg. C / 69 % RH	21 deg. C / 58 % RH
Engineer	Yuta Moriya (Above 1 GHz)	Takafumi Noguchi (Below 1 GHz)
Mode	Tx BT LE 2440 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	46.220	QP	24.5	12.0	6.9	28.1	-	15.3	40.0	24.7	
Hori	91.183	QP	33.0	8.5	7.4	28.0	-	20.9	43.5	22.6	
Hori	144.015	QP	29.9	14.7	7.8	27.8	-	24.6	43.5	18.9	
Hori	251.798	QP	32.7	12.6	8.4	27.1	-	26.6	46.0	19.4	
Hori	306.234	QP	36.0	13.6	8.8	27.2	-	31.2	46.0	14.8	
Hori	384.021	QP	29.1	15.3	9.3	27.7	-	26.0	46.0	20.0	
Hori	4880.000	PK	46.9	31.3	9.0	31.3	-	55.9	73.9	18.0	
Hori	7320.000	PK	44.0	35.6	10.1	32.6	-	57.1	73.9	16.8	
Hori	9760.000	PK	42.9	37.2	11.0	32.7	-	58.4	73.9	15.5	Floor noise
Hori	4880.000	AV	41.7	31.3	9.0	31.3	0.7	51.4	53.9	2.5	
Hori	7320.000	AV	36.4	35.6	10.1	32.6	0.7	50.2	53.9	3.7	
Hori	9760.000	AV	32.0	37.2	11.0	32.7	-	47.5	53.9	6.4	Floor noise
Vert	46.490	QP	33.6	11.9	6.9	28.1	-	24.3	40.0	15.7	
Vert	91.183	QP	38.0	8.5	7.4	28.0	-	25.9	43.5	17.6	
Vert	144.015	QP	30.0	14.7	7.8	27.8	-	24.7	43.5	18.8	
Vert	251.798	QP	37.9	12.6	8.4	27.1	-	31.8	46.0	14.2	
Vert	306.234	QP	38.3	13.6	8.8	27.2	-	33.5	46.0	12.5	
Vert	384.021	QP	26.0	15.3	9.3	27.7	-	22.9	46.0	23.1	
Vert	4880.000	PK	46.1	31.3	9.0	31.3	-	55.1	73.9	18.8	
Vert	7320.000	PK	44.9	35.6	10.1	32.6	-	58.0	73.9	15.9	
Vert	9760.000	PK	43.6	37.2	11.0	32.7	-	59.1	73.9	14.8	Floor noise
Vert	4880.000	AV	40.3	31.3	9.0	31.3	0.7	50.0	53.9	3.9	
Vert	7320.000	AV	38.2	35.6	10.1	32.6	0.7	52.0	53.9	1.9	
Vert	9760.000	AV	32.0	37.2	11.0	32.7	-	47.5	53.9	6.4	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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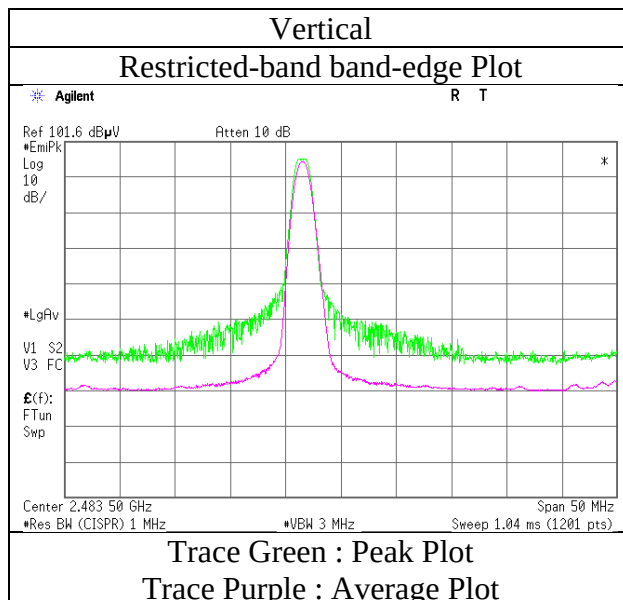
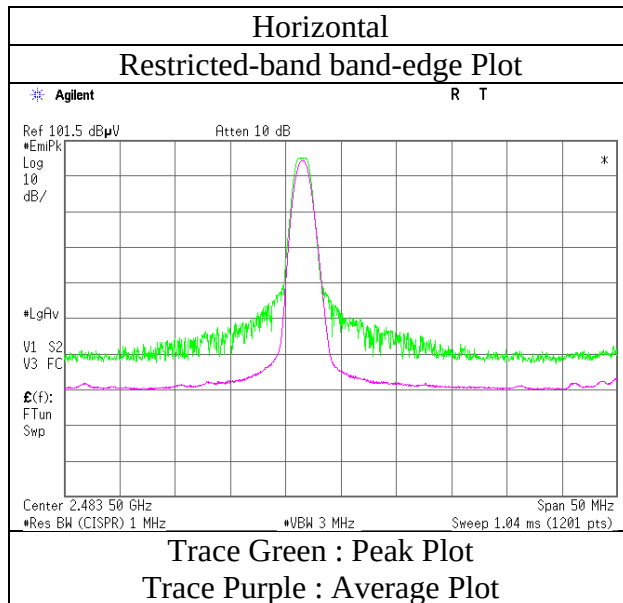
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Radiated Spurious Emission (Reference Plot for band-edge)

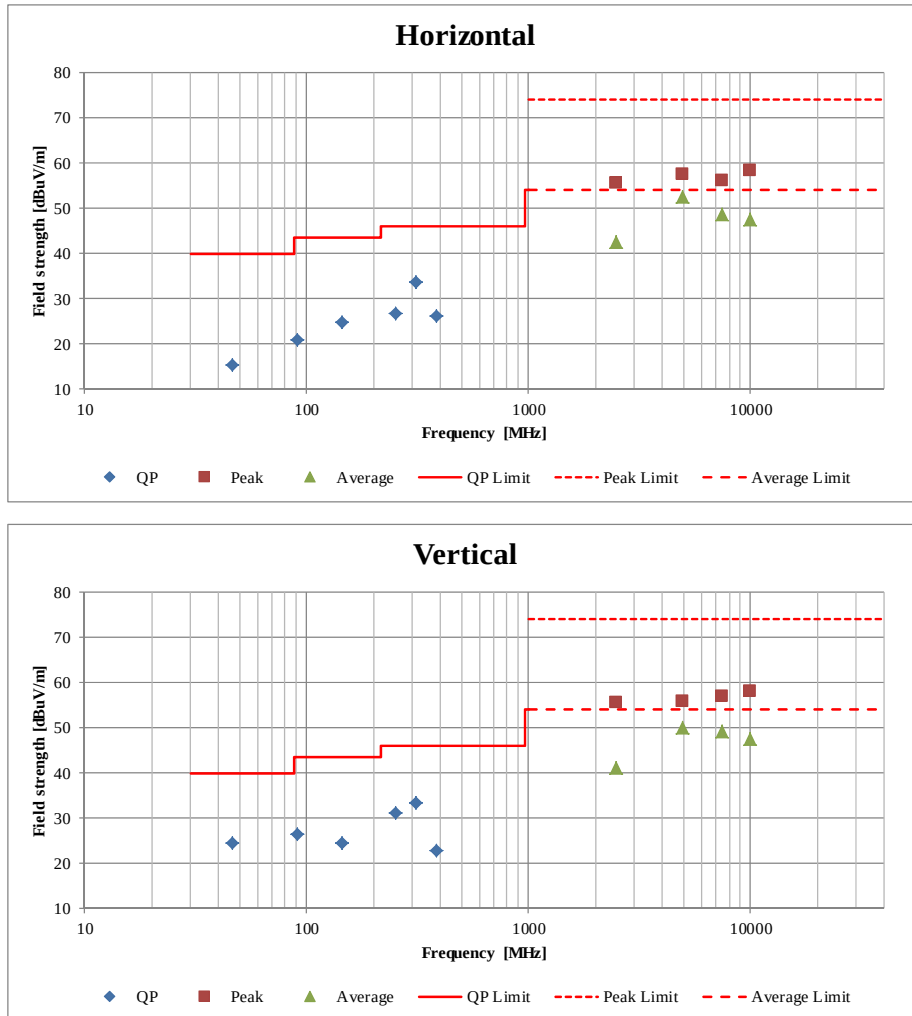
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11451821H
Date	September 18, 2016
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Yuta Moriya
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission (Plot data, Worst case)

Test place	Ise EMC Lab.	
Report No.	11451821H	
Semi Anechoic Chamber	No.4	No.2
Date	September 18, 2016	September 19, 2016
Temperature / Humidity	23 deg. C / 69 % RH	21 deg. C / 58 % RH
Engineer	Yuta Moriya (Above 1 GHz)	Takafumi Noguchi (Below 1 GHz)
Mode	Tx BT LE 2480 MHz	



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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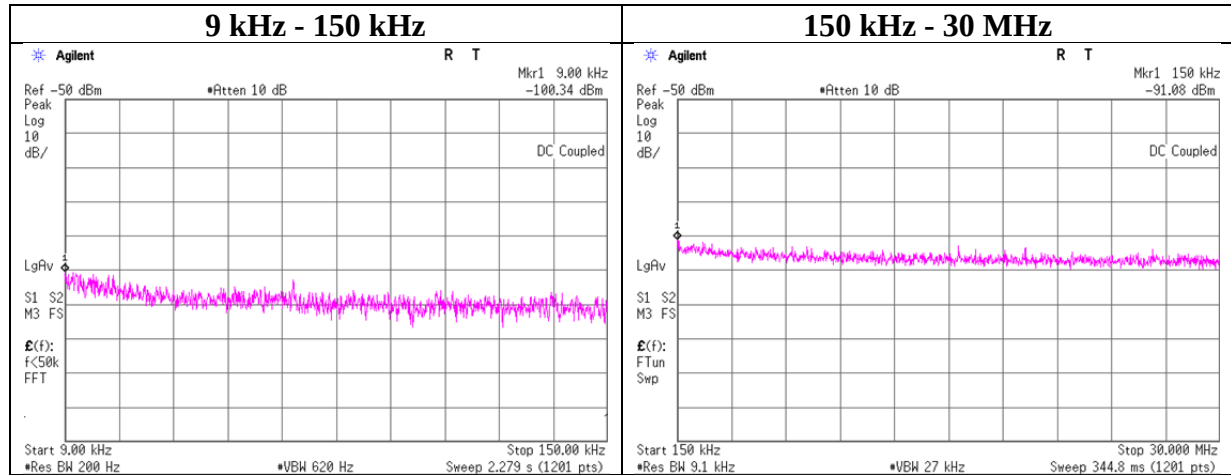
Telephone : +81 596 24 8999

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Conducted Spurious Emission

Test place	Ise EMC Lab. No.4 Measurement Room
Report No.	11451821H
Date	September 19, 2016
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Masafumi Niwa
Mode	Tx BT LE

2402MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.00	-100.3	0.71	9.8	2.0	1	-87.8	300	6.0	-26.6	48.5	75.1	
150.00	-91.1	0.71	9.8	2.0	1	-78.5	300	6.0	-17.3	24.0	41.3	

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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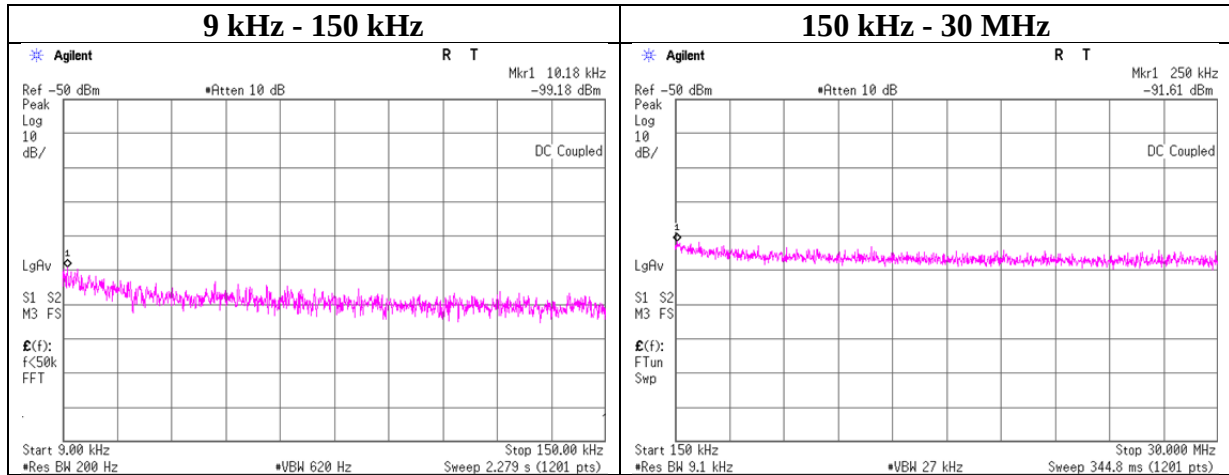
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Conducted Spurious Emission

Test place	Ise EMC Lab. No.4 Measurement Room
Report No.	11451821H
Date	September 19, 2016
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Masafumi Niwa
Mode	Tx BT LE

2440MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.18	-99.2	0.71	9.8	2.0	1	-86.7	300	6.0	-25.4	47.4	72.8	
250.00	-91.6	0.71	9.9	2.0	1	-79.1	300	6.0	-17.8	19.6	37.4	

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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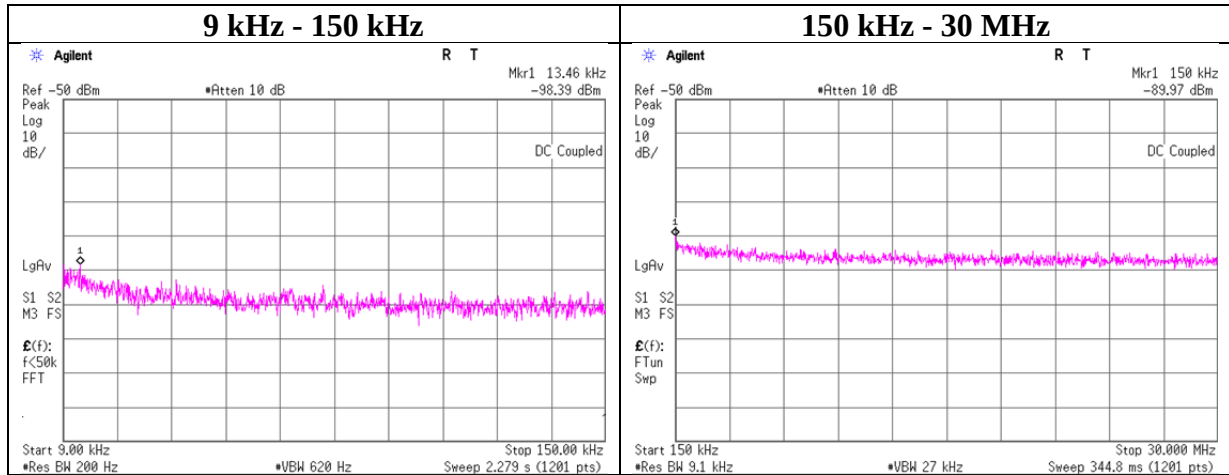
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Conducted Spurious Emission

Test place	Ise EMC Lab. No.4 Measurement Room
Report No.	11451821H
Date	September 19, 2016
Temperature / Humidity	20 deg. C / 58 % RH
Engineer	Masafumi Niwa
Mode	Tx BT LE

2480MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.46	-98.4	0.71	9.8	2.0	1	-85.9	300	6.0	-24.6	45.0	69.6	
150.00	-90.0	0.71	9.8	2.0	1	-77.4	300	6.0	-16.2	24.0	40.2	

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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Power Density

Test place Ise EMC Lab. No.4 Measurement Room
Report No. 11451821H
Date September 19, 2016
Temperature / Humidity 20 deg. C / 58 % RH
Engineer Masafumi Niwa
Mode Tx BT LE

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-25.04	1.70	10.06	-13.28	8.00	21.28
2440.00	-24.82	1.71	10.06	-13.05	8.00	21.05
2480.00	-24.87	1.72	10.06	-13.09	8.00	21.09

Sample Calculation:

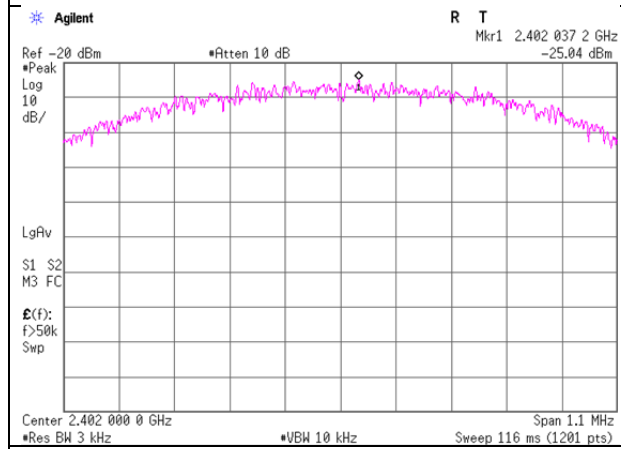
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

*The equipment and cables were not used for factor 0 dB of the data sheets.

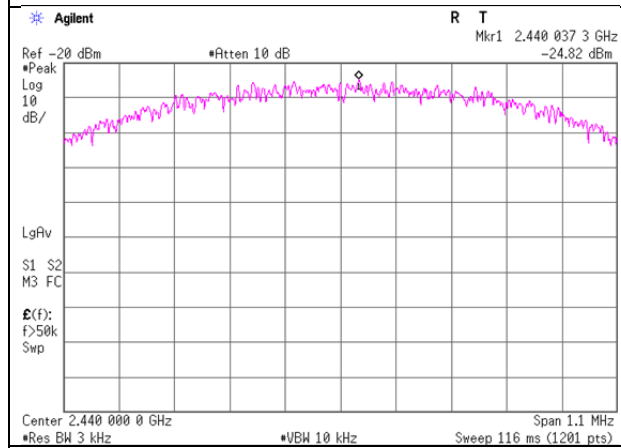
Power Density

BT LE

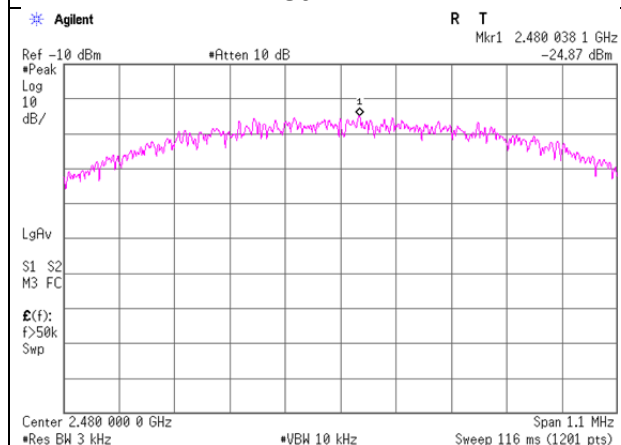
2402 MHz



2440 MHz



2480 MHz



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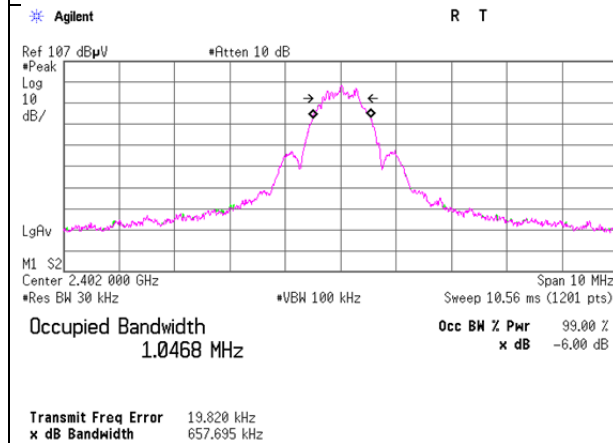
Facsimile : +81 596 24 8124

99%Occupied Bandwidth

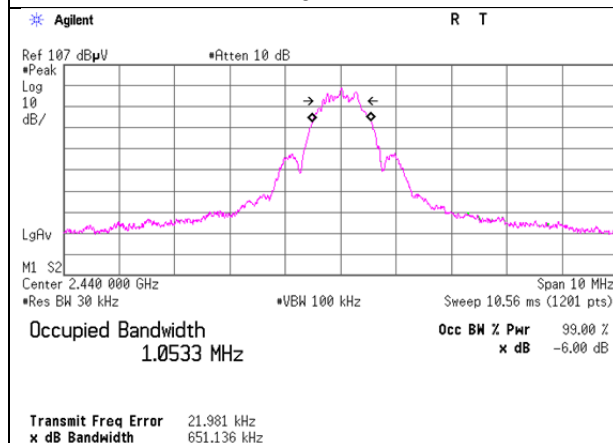
Test place Ise EMC Lab. No.4 Measurement Room
Report No. 11451821H
Date September 19, 2016
Temperature / Humidity 20 deg. C / 58 % RH
Engineer Masafumi Niwa
Mode Tx BT LE

BT LE

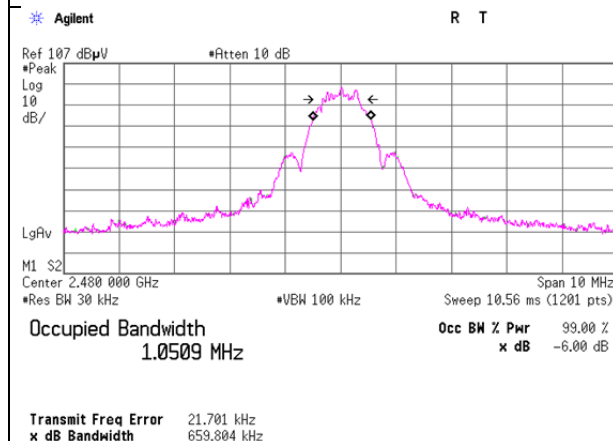
2402 MHz



2440 MHz



2480 MHz



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APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2016/01/21 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2015/11/06 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2016/05/29 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2016/06/21 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2015/10/01 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2016/06/24 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2016/01/18 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2015/10/19 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2015/10/19 * 12
MRENT-130	Spectrum Analyzer	Agilent	E4440A	MY46187750	AT	2016/06/03 * 12
MAT-58	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/01/18 * 12
MCC-174	Microwave Cable	Junkosha	MWX221	1409S497	AT	2016/03/11 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2016/03/10 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE/CE	2015/10/07 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE/CE	2015/10/11 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2016/01/30 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2016/09/13 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2016/08/23 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE	2016/07/07 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2016/02/08 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MPM-16	Power Meter	Agilent	8990B	MY51000271	AT	2016/04/07 * 12
MPSE-22	Power sensor	Agilent	N1923A	MY54070003	AT	2016/04/07 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/01/18 * 12
MOS-34	Thermo-Hygrometer	Custom	CTH-201	3401	AT	2016/01/21 * 12
MMM-16	DIGITAL HiTESTER	Hioki	3805	070900532	AT	2016/01/13 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: CE: Conducted Emission test
RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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